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Linguistic and Musical Syntactic Processing in Aphasia: Is There a Relationship?

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Introduction

Western music has a hierarchical structure that may rely on the same cognitive and neural resources used for syntactic processing in language (Patel, 2003). Supporting evidence comes from psycholinguistic and neuroimaging studies (e.g., Koelsch, 2006). It is less clear if left hemisphere damage disrupts both linguistic and musical syntax given dissociations between aphasia and amusia (Peretz, 2006) and because previous investigations of musical syntactic processing in aphasia yielded somewhat equivocal results (Patel et al., 2008). Therefore this study investigated whether there is a relationship between processing of musical and linguistic structure in persons with left hemisphere damage relative to neurologically healthy adults.

Methods

Participants were eleven participants with aphasia (WAB aphasia quotient range: 26-95) and ten age-matched neurologically healthy controls. All were native speakers of English with at least high school education.

We constructed four tasks to capture "off-line" and "on-line" sensitivity to structure in language and in music. Off-line measures were acceptability judgment tasks: judging sentences that sometimes contained morphosyntactic violations and judging chord sequences that sometimes included a (well-tuned) chord from a distant key. On-line sensitivity to linguistic structure was assessed with a word monitoring task, where target words sometimes followed morphosyntactic violations. On-line sensitivity to musical structure was assessed with a harmonic priming task, where participants made timbre judgments (trumpet or voice) on the final chords of sequences that ended on harmonically expected (tonic) or less expected (subdominant) chords. Participants also provided self-report information on extent of musical experience.

Results and Discussion

Both aphasic and control participants discriminated ungrammatical from grammatical sentences, however aphasic participants performed significantly worse on this off-line linguistic acceptability judgment task (d' = 1.6 vs. control d' = 2.4; t = 3.42). In contrast, word monitoring responses were slowed following a grammatical violation for both aphasic and control participants (no interaction with subject group). These participants thus show a dissociation between off-line and on-line measures of sensitivity to linguistic syntax.

Participant groups also did not differ on the off-line musical acceptability task: both groups performed above chance (aphasics d' = 0.84; controls d' = 1.09) and control participants' performance correlated with musical experience (r = .83). Finally, participant groups showed equivalent harmonic priming effects, thus also did not differ

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in on-line sensitivity to musical structure. Sensitivity to musical structure thus dissociates from (off-line) sensitivity to linguistic structure, lending no support to a relationship between the processing of linguistic and musical structure. Instead, such a relationship may be moderated by other factors such as working memory or cognitive control.

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